MARK SCHEME for the October/November 2012 series

5054 PHYSICS

5054/21   Paper 2 (Theory), maximum raw mark 75

Section A

1 (a) 950 N   B1
       upwards   B1

(b) correct rectangle **and** diagonal **and** at least one velocity labelled
     or correct triangle and at least one velocity labelled
     (either way round)   B1
     from 7.8(0000) to 8.0(0000) m / s (inclusive)   B1
     scale stated   B1   [5]

2 (a) (i) output/voltage/e.m.f. (directly) proportional to temperature (difference)   B1

     (ii) $\dfrac{7.70 - 6.20}{800 - 750}$ **or** 1.5/50 **or** 0.03 **or** 0.6/1.5 **or** 20(°C)   C1
          770 °C   A1

(b) glass melts/liquid boils/no remote reading (e.g. head in furnace)   B1   [4]

3 (a) (i) (WD =)mgh **or** 54 × 10 × 2.8   C1
          1500/1510/1512 J   A1

     (ii) (P =) WD/t **or** E/t **or** 1500/3 **or** 1510/3 **or** 1512/3   C1
          500/503/504 W   A1

(b) any **two** of:
     also lifting board/rope
     heat in motor/wires/cable
     friction with something named e.g. axle/spindle/air   B2

(c) (i) power supply, motor and ammeter in series
          (**ignore** series voltmeter and other components)   B1
          voltmeter to measure voltage across motor   B1

     (ii) current (reading) × voltage (reading) **or** VI B1   [9]

4 (a) (m=)ρV **or** 740 × 30 or 22 000/22 200   C1
     25 000/2.5 × 10^4 kg (allow 24 800 from 22 000)   A1

(b) (a =)F/m **or** 30 000/25 000   C1
     (−)1.2 m/s^2 A1   [4]

5 (a) (i) clear attempt at measuring more than one wavelength e.g. 6.85/5
or 1.30 – 1.45 cm   B1
10.7 – 11.3 cm   B1

    (ii) $(v =)f\lambda$ or 3.6 × **(a)(i)**   C1
40(39.6) cm / s   A1

(b) (i) stays the same   B1

    (ii) decreases   B1   [6]

6 (a) any **three** of:
infra-red and microwaves reversed
visible light is omitted
ultrasound is not e.m./should not be included
ultraviolet is missing ('ultrasound instead of light' scores 2)   B3

(b) engineering use   M1   detail/explanation   A1

detecting cracks in metal   (more) X-rays pass through
                            crack/poor weld
or   **or**
checking welds   image of crack on film/screen
astronomy   hot stars emit X-rays
crystallography   diffraction reveals pattern of atoms
fluorescence   substances re-emit different energies
(airport/border) security   contents of luggage/lorries revealed
paintings investigated   underpainting revealed

(**not** medical use)   [5]

7 (a) (at least) **two** parallel horizontal lines within the cylinder   B1
(at least) **two** correctly shaped lines outside the cylinder   B1

(b) (i) ◄——————— (right to left) **and** on diagram (somewhere)   B1

    (ii) 1. path continuously curving in same direction   M1
         upwards (**ignore** lines outside the shaded area)   A1
    2. (changes to) downwards (curve) **not** reverses/opposite direction   B1   [6]

8 **(a)** **(i)** $(V =)IR$ or 0.025×600 C1
             15 V   A1

       (ii) 5(V) **or** 5/0.025 **or** 800 **or** 800–600   C1
              200 Ω   A1

     (b) **(i)** decreases   B1

       (ii) ammeter: opposite to **(i)**
             voltmeter: same as ammeter (both changes correct)   B1   [6]

[Total: 45]

Section B

9 **(a)** **(i)** $(\Delta P=)\rho gh$ **or** $1000 \times 10 \times 120$ C1
              1.2×10^6 Pa   A1

       (ii) 1.3×10^6 Pa   B1   [3]

     (b) **(i)** $(F =)PA$ **or** $1.2 \times 10^6 \times 0.45$ **or** $1.3 \times 10^6 \times 0.45$ **or** 5.4×10^5 (N)   C1
              $5.8/5.85/5.9 \times 10^5$ N   A1

       (ii) any **two** of:
             weight of hatch
             pressure inside submarine
             friction at seal/hinge/water resistance
             lever effect   B2   [4]

     (c) **(i)** sound or pressure wave   B1
             frequency > 20 kHz/**frequency** beyond human hearing/inaudible   B1

       (ii) (water) molecules/particles vibrate/oscillate   B1
             molecules collide with other molecules/neighbours   B1
             pass on vibration/energy (to neighbours)
             or longitudinal (vibration/wave) or compressions and rarefactions   B1

       (iii) **1.** speed of sound/ultrasound (in water/sea water)   B1
             2. speed × t ÷ 2   B1

       (iv) cleaning/quality control/detecting cracks/prenatal screening/
             kidney stones/detecting shoals of fish/(used by dolphins/bats)   B1   [8]

[Total: 15]

10 (a) 16 × 7.5 **or** 120 **or** 96–17 **or** 79   C1
       $(Q =)mc\Delta T$ **or** 120 × 2300 × 79   C1
       $2.2(2.1804) \times 10^7$ J   A1   [3]

(b) (i) $2.2 \times 10^7/7$ **or** $2.2 \times 10^7/ (7 \times 60)$ **or** $2.2 \times 10^7/ (7 \times 3600)$ C1
       3.1×10^6 J/h **or** 5.2×10^4 J/min **or** 870 J/s **or** W   A1

      (ii) (heater/bricks) hot(ter) (**not** room cooler)   B1
           great(er) temperature difference (between heater and room)   B1   [4]

(c)   air (next to heater) gets hot **or** conduction through metal/casing   B1
        expands **or** radiation **or** IR (radiation)   B1
        less dense   B1
        rises   B1
        circulation **or** convection current **or** arrows on Fig. 10.2   B1   [5]

(d) double glazing/cavity walls/ceiling
      tiles/carpet/curtains/loft insulation etc.   **or**   shiny foil   B1
      traps air   radiation reflected   M1
      air is poor conductor/convection   IR radiation/
      prevented   back into room   A1   [3]

[Total: 15]

11 (a) (i) correct negative charges on tree.   B1

      (ii) electrons/-ve charges attracted by cloud/+ve charges   B1
           electrons from ground **or** correct induction mentioned   B1

      (iii) 1. $560/1.6 \times 10^{-19}$ C1
                3.5×10^{21} A1

           2. $(I =)Q/t$ **or** $560/2 \times 10^{-4}$ C1
                2.8×10^6 A   A1   [7]

     (b) (i) at least 4 vertical lines between plates   B1
           equally spaced **or** curved at edges   B1
           arrows +ve to –ve/upwards   B1

      (ii) oil droplet positively charged   B1
           attraction/force on (droplet) and in direction of field/upwards   B1
           force greater than weight (of droplet) **or** resultant force   B1

      (iii) (droplet becomes) negative   C1
           (droplet) gains electrons   A1   [8]

[Total: 15]